



National Aeronautics and Space Administration



Manufacturing

Non-Collinear Valve Actuation System

The non-collinear arrangement of a primary actuator and return spring system reduces the mass and footprint of traditional valve actuation systems.

NASA's Marshall Space Flight Center scientists have invented a novel valve actuator where the primary actuating system and return spring system are arranged non-collinearly. In the past, valve actuators have employed pressure-actuated piston and return spring systems with a linear arrangement that require bulky return springs. The need to reduce the mass of valve actuators for flight systems resulted in NASA's non-collinear valve actuator. The actuator may be used in a variety of applications that will benefit from lighter actuating systems or a smaller system footprint. A prototype of the NASA actuator has been built to regulate the flow of a quarter-turn ball valve. NASA is seeking partners who are interested in co-development or licensure of this novel technology.

BENEFITS

- **Lower mass** – the NASA actuating system has lower overall actuator mass than other conventional collinear designs.
- **Compact** – the non-collinear design enables more compact, smaller footprint actuation systems.
- **Reliability** – shorter stroke length of the return spring system may lead to longer actuator life.
- **Lower cost** – use of Belleville springs reduces actuator system component cost.

APPLICATIONS

If your company is interested in any of these technologies, or if you would like additional information on them or NASA's technology transfer program, please contact:

- Chemical plants
- Electrical power generating plants, particularly nuclear facilities
- Liquid-fuel rocket propulsion
- Oil and gas producers and refiners
- Water supply and treatment
- Iron and steel plants

technology solution



THE TECHNOLOGY

The actuator and return spring are connected non-collinearly using a rotably-affixed four bar linkage arm. The non-collinearity of the primary actuating system and return spring system of the NASA actuator allows the system to use a larger stroke while the return spring system experiences significantly less displacement. Therefore, the length and mass of the return spring may be minimized and more efficiently packaged as a smaller actuator. Belleville springs are identified as a useful return spring in the NASA system due to their low cost, small size and weight, and nearly constant force exertion over variable displacement distances.

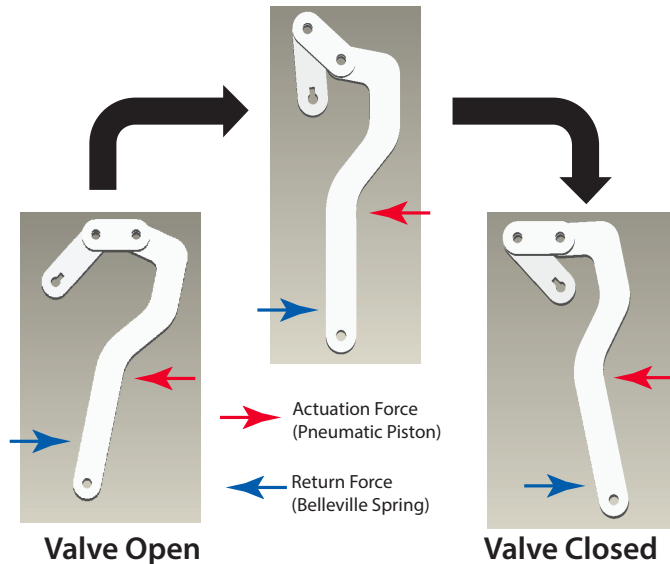


FIGURE 1 – A diagram demonstrating the function of the non-collinear valve actuator is shown above. An actuating force (red arrow) provided by a pneumatic piston causes a four bar linkage arm to rotate to open a quarter turn valve. Return force (blue arrow) to close the valve upon loss of actuating force is provided by the Belleville spring.

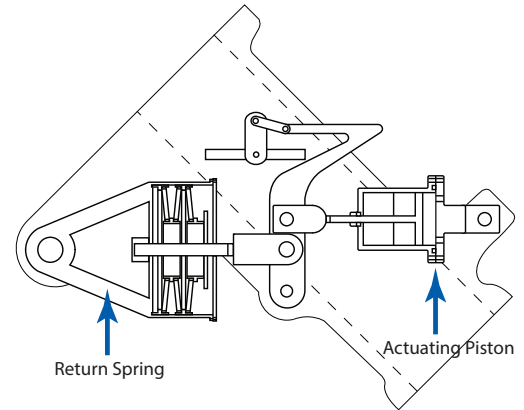


FIGURE 2 – Diagram of the NASA non-collinear actuator for operation of a quarter-turn valve. The return (Belleville) spring is noted at left and the actuating piston at right.

PUBLICATIONS

U.S. Patent No. 8,322,685

National Aeronautics and Space Administration

Sammy A. Nabors

Marshall Space Flight Center

Huntsville, AL 35812

256.544.5226

sammy.nabors@nasa.gov

<http://technology.nasa.gov/>

www.nasa.gov

NP-2014-08-1155-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

MFS-32840-1

